

CLAIMS

We claim:

1. A method in a computer system acting as a host of multiple virtual computer systems for communicating with remote computer systems on behalf of the virtual computer systems, the virtual, remote, and host computer systems each having a unique network address, the communicating on behalf of a virtual computer system performed by using the virtual computer system network address in place of the host computer system network address, the method comprising:

communicating with a first remote computer system on behalf of the host computer system by

creating a first communication socket on the host computer system whose destination is the network address of the first remote computer system;

during establishment of a connection with the first remote computer system using the first communication socket, responding to a query for a source network address for the first communication socket by determining and providing the network address of the host computer system; and

sending a message to the first remote computer system from the host computer system by using the first communication socket, the sent message including the source network address of the host computer system; and

for each of multiple of the virtual computer systems, communicating with a second remote computer system on behalf of that virtual computer system by

determining that a message is to be sent from that virtual computer system to the second remote computer system;

creating a communication socket on the host computer system whose destination is the network address of the second remote computer system;

before using the created communication socket to establish a connection with the second remote computer system, binding the network address of that virtual computer system to be a source of the created communication socket; and

sending a message to the second remote computer system from the host computer system on behalf of that virtual computer system by using the created communication socket, the sent message including the bound source network address of the virtual computer system,

so that the second remote computer system receives communication over the host computer system communication socket as if the host computer system were that virtual computer system.

2. The method of claim 1 including, under control of the second remote computer system:

for each of the multiple virtual computer systems,

receiving the sent message from the host computer system on behalf of the virtual computer system;

determining the source network address of the sent message to be the sent network address of the virtual computer system; and

adding information to the received message indicating that the message was received from the virtual computer system.

3. The method of claim 1 including, under control of the first remote computer system:

receiving the sent message from the host computer system;

determining the source network address of the sent message to be the sent network address of the host computer system; and

adding information to the received message indicating that the message was received from the host computer system.

4. The method of claim 1 wherein the sent messages are emails.

5. The method of claim 4 wherein the sending of the emails is performed by an executing copy of Sendmail.

6. The method of claim 1 wherein the unique network address for each of the virtual, remote, and host computer systems is an Internet Protocol address.

7. The method of claim 1 wherein the unique network address for each of the virtual, remote, and host computer systems is a Domain Name System domain name.

8. The method of claim 1 wherein the hosted virtual computer systems share memory, storage and processing of the host computer system.

9. The method of claim 1 wherein the determining that a message is to be sent from a virtual computer system to the second remote computer system includes:

receiving an indication from a remote user to access resources of the virtual computer system;

after determining that the remote user is a defined user of the virtual computer system, providing access to the resources;

receiving an indication from the remote user to create a message having a recipient that is a user of the second remote computer system; and

creating the message from the defined user of the virtual computer system with the user of the second remote computer system as a recipient,

and wherein the message sent to the second remote computer system from the host computer system on behalf of the virtual computer system is the created message.

10. The method of claim 9 including, after the creating of the message and before the sending of the message, storing the created message temporarily in a queue of outgoing messages for the virtual computer system.

11. The method of claim 1 wherein the query for the source network address for the first communication socket is made by an operating system of the host computer system.

12. A method in a computing device having an assigned network address and having multiple distinct associated virtual network addresses, the method for communicating with remote computing devices using one of the virtual network addresses in place of the assigned network address, the method comprising:

for each of multiple of the virtual network addresses, communicating with a remote computing device having a specified network address by

creating a communication socket whose destination is the specified network address;

before using the created communication socket to send information to the remote computing device, binding the virtual network address to the created communication socket so as to be a source network address for the created communication socket; and

sending information to the remote computing device using the created communication socket, the sent information including the bound source virtual network address,

so that the remote computing device receives communications over the communication socket as if the computing device were assigned the virtual network address.

13. The method of claim 12 including:

creating a first communication socket whose destination is a network address of a first remote computing device; and

without binding a virtual network address to the first communication socket, sending information to the first remote computing device using the first communication socket such that the sent information includes the assigned network address.

14. The method of claim 13 including, under control of the first remote computing device:

receiving the information sent from the computing device using the first communication socket; and

determining a source of the sent information to be the assigned network address of the computing device.

15. The method of claim 12 including, under control of one of the remote computing devices to which information was sent using a created communications socket having a bound source virtual network address:

receiving the information sent from the computing device; and

determining a source of the sent information to be the virtual network address bound to the created communication socket.

16. The method of claim 12 wherein the virtual network addresses are IP addresses.

17. The method of claim 12 wherein the virtual network addresses are domain names.

18. The method of claim 12 wherein the virtual network addresses are hosted by the computing device as a service to customers.

19. The method of claim 12 wherein the communicating with a remote computing device having a specified network address for a first virtual network address includes, before the creating of the communication socket:

receiving an indication from a user associated with the first virtual network address to create a message having a recipient that is a user of the remote computing device; and

creating the message with the virtual user as a sender, with the user of the remote computing device as a recipient, and with the virtual network address included in the message,

and wherein the created message is the information sent to the remote computing device using the created communication socket.

20. The method of claim 19 including, after the creating of the message and before the sending of the message, storing the created message temporarily in a queue of outgoing messages associated with the virtual network address.

21. The method of claim 12 wherein the sending of information to a remote computing device using a created communication socket includes:

making a connection request to the remote computing device over the created communication socket, the connection request including an indication of the virtual network address; and

receiving an indication from the remote computing device that the connection is accepted.

22. The method of claim 12 including:

receiving an email sent from a remote computing device that is a host for a virtual network address, the remote computing device sending the email over a communication socket to which the virtual network address is bound; and

adding a Received header line to the received email indicating that the email was received from the virtual network address.

23. The method of claim 12 wherein the information sent to at least one of the remote computing devices is an email.

24. A computer-readable medium whose contents cause a computing device to communicate with a remote computing device, the computing device having an assigned network address and having multiple distinct associated virtual network addresses, the communicating using one of the virtual network addresses in place of the assigned network address by:

for at least one of the virtual network addresses, communicating with a remote computing device having a specified network address by

creating a communication socket whose destination is the specified network address;

before using the created communication socket to send information to the remote computing device, binding the virtual network address to the created communication socket so as to be a source network address for the created communication socket; and

sending information to the remote computing device using the created communication socket, the sent information including the bound source virtual network address.

25. The computer-readable medium of claim 24 wherein the computer-readable medium is a memory of a computer system.

26. The computer-readable medium of claim 24 wherein the computer-readable medium is a data transmission medium transmitting a generated data signal containing the contents.

27. A computing device for communicating with a remote computing device, the computing device having an assigned network address and having multiple distinct associated virtual network addresses, comprising:

a first module capable of creating a communication socket whose destination is a specified network address of a remote computing device and of, before using the created communication socket to send information to the remote computing device,

binding one of the virtual network addresses to the created communication socket so as to be a source network address for the created communication socket; and

a second module capable of sending information to the remote computing device using the created communication socket, the sent information including the bound source virtual network address.

28. The computing device of claim 27 wherein the first and second modules are executing in memory of the computing device.

29. A computing device for communicating with a remote computing device, the computing device having an assigned network address and having multiple distinct associated virtual network addresses, comprising:

means for creating a communication socket whose destination is a specified network address of a remote computing device;

means for, before using the created communication socket to send information to the remote computing device, binding one of the virtual network addresses to the created communication socket so as to be a source network address for the created communication socket; and

means for sending information to the remote computing device using the created communication socket, the sent information including the bound source virtual network address.

30. A method for sending emails by a computing device that is a host for multiple virtual domains that each have a distinct network identifier, the sending of the emails on behalf of users of the virtual domains by using the distinct network identifiers for the virtual domains in place of a network identifier for a non-virtual domain associated with the computing device, the method comprising:

for each of multiple of the virtual domains, sending an email from the virtual domain to a remote domain having a specified network identifier by

creating a communication socket whose destination is the specified remote domain;

before using the created communication socket to send the email to the remote domain, binding the distinct network identifier for the virtual domain as a source for the created communication socket, the binding such that information sent to the remote domain using the created communication socket will indicate the bound network identifier as a source of the sent information; and

sending the email to the remote domain using the created communication socket.

31. The method of claim 30 including, under control of one of the remote domains to which an email was sent using a created communications socket having a bound source network identifier for a virtual domain:

receiving the email sent from the host computing device; and

adding a Received header line to the received email indicating that the email was received from the virtual domain.

32. The method of claim 30 including, for each of the multiple virtual domains, retrieving the email to be sent from a queue of outgoing messages associated with the virtual domain.

33. The method of claim 30 including:

creating a first communication socket whose destination is a network address of a first remote domain; and

without binding a network identifier for a virtual domain to the first communication socket, sending information to the first remote domain using the first communication socket such that the sent information includes the network identifier for the non-virtual domain associated with the host computing device.

34. A computer-readable medium containing instructions that when executed cause a computing device to send an email to a remote domain on behalf of a user of a first virtual domain, the first virtual domain being one of multiple virtual domains that are hosted by the computing device and that each have a distinct network identifier, the sending of the email using the distinct network identifier for the first virtual domains in place of a network identifier for a non-virtual domain associated with the computing device, by:

creating a communication socket whose destination is the remote domain;

before using the created communication socket to send the email to the remote domain, binding the distinct network identifier for the first virtual domain as a source for the created communication socket, the binding such that information sent to the remote domain using the created communication socket will indicate the bound network identifier as a source of the sent information; and

sending the email to the remote domain using the created communication socket.

35. A computing device for sending an email to a remote domain on behalf of a user of a first virtual domain, the computing device hosting multiple virtual domains including the first virtual domain, each virtual domain having a distinct network identifier, comprising:

a first module capable of creating a communication socket whose destination is the specified remote domain and of, before using the created communication socket to send the email to the remote domain, binding the distinct network identifier for the first virtual domain as a source for the created communication socket, the binding such that information sent to the remote domain using the created communication socket will indicate the bound network identifier as a source of the sent information; and

a second module capable of sending the email to the remote domain using the created communication socket.

36. A method for sending messages by a computing device that is a host for multiple virtual users, the computing device having an assigned network address and each of the virtual users being associated with a virtual network address distinct from the assigned network address, the sending of a message for a virtual user performed by using the virtual network address associated with the virtual user in place of the assigned network address, the method comprising:

- receiving a request from a user to send a message to a recipient on a remote computing device;

- determining that the user is one of the virtual users;

- retrieving the virtual network address associated with the one virtual user;

and

- sending the message to the recipient on the remote computing device by

- binding the retrieved virtual network address to a communication mechanism to be used for the sending, the binding such that information sent using the created communication socket will indicate the bound virtual network address to be a source of the sent information; and

- sending the message to the remote computing device using the communication mechanism.

37. The method of claim 36 including, under control of the remote computing device:

- receiving the message sent from the host computing device; and

- determining a source of the sent message to be the bound virtual network address.

38. The method of claim 36 including, before the receiving of the request from the user to send the message:

- receiving an indication from the one virtual user to create the message; and

- creating the message with the one virtual user as a sender and with the virtual network address associated with the one virtual user included in the message.

39. The method of claim 38 including, after the creating of the message and before the sending of the message, storing the created message temporarily in a queue of outgoing messages associated with the virtual user.

40. A computer-readable medium whose contents cause a computing device to send messages for a virtual user of the computing device, the computing device having an assigned network address and being a host for multiple virtual users, each of the virtual users being associated with a virtual network address distinct from the assigned network address, by:

receiving a request from a user to send a message to a recipient on a remote computing device;

determining that the user is one of the virtual users;

retrieving the virtual network address associated with the one virtual user;

and

sending the message to the recipient on the remote computing device by

binding the retrieved virtual network address to a communication mechanism to be used for the sending, the binding such that information sent using the created communication socket will indicate the bound virtual network address to be a source of the sent information; and

sending the message to the remote computing device using the communication mechanism.

41. A computing device for sending messages on behalf of a virtual user, the computing device having an assigned network address and being a host for multiple virtual users, each of the virtual users being associated with a virtual network address distinct from the assigned network address, comprising:

a first module capable of receiving a request from a user to send a message to a recipient on a remote computing device and of determining that the user is one of the virtual users; and

a second module capable of retrieving the virtual network address associated with the one virtual user and of sending the message to the recipient on the remote computing device by binding the retrieved virtual network address to a communication mechanism to be used for the sending such that information sent using the created communication socket will indicate the bound virtual network address to be a source of the sent information and by sending the message to the remote computing device using the communication mechanism.